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Effect of Organic Fertilizer Type and Nitrogen Fertilizer Dosage on Growth and Yield of Lettuce (Lactuca sativa L.)

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Abstract

This study aims to study the effect of organic fertilizer application and optimal nitrogen fertilizer dosage on the growth and yield of lettuce plants (Lactuca sativa L.). The research was carried out in Medankarya Village, Tirtajaya District, Karawang Regency from September to October 2019. The research method used was an experiment using Split Plot Design. There were 12 treatments that were repeated 3 times each. The main plot is a type of organic fertilizer (p) consisting of 3 types, namely: p1 = cow manure, p2 = goat manure, and p3 = chicken manure. Meanwhile, the plot is a dose of nitrogen fertilizer (n) consisting of 4 levels, namely: n0 = 0 Kg/ha-1, n1 = 50 Kg/ha-1, n2 = 100 Kg/ha-1 and n3 = 150 Kg/ha-1. The results showed that there was an interaction between the type of organic fertilizer and the dose of nitrogen fertilizer on the height of plants aged 28 days after planting and the leaf area index. The type of cow manure organic fertilizer and nitrogen dose of 100 Kg/ha-1 gave the highest yield in wet weight per plant on lettuce of 79.26 g.

Keywords: Green Manure, Incubation Period, Chemical Aspect, Ultisol

Abstract

Penelitian ini bertujuan untuk mempelajari pengaruh pemberian jenis pupuk organik dan dosis pupuk nitrogen yang optimum terhadap pertumbuhan dan hasil tanaman selada (Lactuca sativa L.). Penelitian dilaksanakan di Desa Medankarya Kecamatan Tirtajaya Kabupaten Karawang dari bulan September sampai dengan bulan Oktober 2019. Metode penelitian yang digunakan adalah eksperimen dengan menggunakan Rancangan Petak Terbagi (Split Plot Design). Terdapat 12 perlakuan yang masing-masing diulang 3 kali. Petak utama adalah jenis pupuk organik (p) yang terdiri dari 3 jenis, yaitu : p1 = kotoran sapi, p2 = kotoran kambing, dan p3 = kotoran ayam. Sedangkan anak petak adalah dosis pupuk nitrogen (n) yang terdiri dari 4 taraf, yaitu : n0 = 0 Kg/ha-1, n1 = 50 Kg/ha-1, n2 = 100 Kg/ha-1 dan n3 = 150 Kg/ha-1. Hasil penelitian menunjukkan bahwa terjadi interaksi antara jenis pupuk organic dan dosis pupuk nitrogen terhadap tinggi tanaman umur 28 hst dan indeks luas daun. Jenis pupuk organic kotoran sapi dan dosis nitrogen 100 Kg/ha-1memberikan hasil tertinggi pada bobot basah per tanaman pada selada sebesar 79,26 g.

Keywords: Selada, Pupuk Organik, Dosis Pupuk Nitrogen

1. Introduction

Vegetables are a commodity that has very good development, because they are needed every day and demand tends to continue to increase(Nurdiansyah, 2020),(Wahyudi, 2020).

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Just like other horticultural crops, most vegetable plants have quite high commercial value. This fact can be understood because vegetables are always consumed at all times(Wahyudin & Irwan, 2019),(Rochman, 2017). Apart from that, vegetables are a vegetable commodity that is really needed by society because they contain many nutrients that are needed by people(Ismawati, Rahayu, & Rachmawatie, 2021),(Mamuaja, 2016).

Lettuce (Lactuca sativa L.) is a horticultural commodity that has quite good prospects and commercial value. The increasing population of Indonesia and the increasing awareness of the population's nutritional needs have led to an increase in demand for vegetables(Manullang, Hasibuan, & CH, 2019),(Mundari, 2017). The nutritional content of vegetables, especially vitamins and minerals, cannot be substituted for staple foods(GOOD & CULTURE, nd),(Pratiwi, Subandi, & Mustari, 2015).

The increasing need for lettuce must be followed by an increase in lettuce production which can be done through lettuce cultivation techniques. The success of lettuce cultivation is influenced by environmental factors. One important factor that can influence the growth and production of a plant is the availability of nutrients(Muhadiansyah, Setyono, & Adimihardja, 2016). One effort that can be made to increase crop yields is the combined use of organic fertilizers and nitrogen fertilizers, which is expected to increase plant productivity, reduce the use of inorganic fertilizers, save on fertilizer costs, improve the physical, chemical and biological properties of soil, and increase fertilizer efficiency.(ISWARI, 2018),(Nehe, 2020).

There are many factors that need to be considered in cultivating plants to get optimum results and good quality, one of which is the cultivation factor, namely through fertilizing with organic or inorganic materials. The inorganic fertilizer most needed for lettuce plants is nitrogen (N) fertilizer.(Mansyur, Pudjiwati, & Murtilaksono, 2021). Nitrogen is a limiting factor for the growth and yield of lettuce plants because the main product is leaves. The results of soil fertility analysis before the experiment showed that the total N content in the soil was very low (0.05%) and organic C was also low (Analysis Attached). This shows that lettuce growth requires N fertilizer and organic fertilizer.(Irawan, 2020).

If the use of inorganic fertilizer such as urea is accompanied by the provision of organic fertilizer, the N from urea is not easily lost through evaporation or leaching. Therefore, the application of inorganic fertilizer needs to be combined with the application of organic material, either in the form of manure, biological fertilizer or green fertilizer. The aim of providing organic materials, apart from improving the physical, chemical and biological properties of the soil, can also reduce the use of inorganic fertilizers, thereby reducing production costs and reducing environmental pollution. One way is to use animal manure.

One type of organic fertilizer that is expected to improve soil properties and plant yields is animal manure. Animal manure is the result of natural fermentation of organic material which can be used as fertilizer to increase soil fertility so that it can improve plant growth and yield. Using urea fertilizer is easier and more practical and also has the disadvantage that it evaporates easily and decomposes into H2O gas. Therefore, it needs to be combined with animal manure fertilizer even though the nutrient levels contained in animal manure fertilizer are not as high as urea, thus mixing the combination of organic and inorganic fertilizers will produce sufficient nutrients for plants..

2. Materials and Methods

The experiment was carried out in Medankarya Village, Jayakerta District, Karawang Regency, West Java Province. The experimental site is at an altitude of 12 meters above sea level (asl) with gray alluvial soil. Based on rainfall data for the last 10 years from 2007-2017 according to the Schmidt and Ferguson climate classification calculations, the experimental site is included in rainfall type E (rather dry) with a Q value of 103.92%. The experiment was carried out from August 2019 to October 2019.

The materials used are lettuce seeds, water, planting media, nitrogen fertilizer, organic fertilizer (cow manure, goat manure and chicken manure), vegetable pesticides. The tools used are rulers, scales, hoes, wood, stationery, gembor, thermohygrometer.

The research was carried out using an experimental approach with a Split Plot Design in a Completely Randomized Group Design (RKTS) with three replications. The main plot is the type of organic fertilizer (p) divided into 3 types, while the sub plots are the dose of nitrogen fertilizer (n) divided into 4 levels, repeated 3 times so that each replication contains 12 treatment combinations..

Table1Treatment Types of Organic Fertilizer and Nitrogen Fertilizer Dosage.

Treatment Combination	Organic Fertilizer (manure)	Nitrogen Fertilizer (kg ha-1)
p1n0	Cow	0
p1n1	Cow	50
p1n2	Cow	100
p1n3	Cow	150
p2n0	Goat	0
p2n1	Goat	50
p2n2	Goat	100
p2n3	Goat	150
p3n0	Chicken	0
p3n1	Chicken	50
p3n2	Chicken	100
p3n3	Chicken	150

Table2Operational Independent Variables and Dependent Variables

No.	Variable Type	Sub Variable	Variable Indicator
1.	Independent Variable Treatment	1. Types of organic fertilizer (p)	p1, p2, p3
		2. Nitrogen fertilizer dosage (n)	n0, n1, n2, n3
2.	Variable Bound Response	1. Growth Characteristics of Lettuce Plants	1. Plant height
			2. Number of leaves
			3. Leaf area index
		2. Lettuce Plant Results	1. Wet weight per plant
			2. Crop yield per plot
			3. Number of marketable leaves

Table3Analysis of Various Split Plot Designs (Split Plot Design)

SR	Df	SS	EMS

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Repeat	r-1	$\sigma_e^2 + b$
A	a-1	σ_e^2
Error A	(r-1)(a-1)	σ_e^2
B	b-1	σ_e^2
A*B	(a-1)(b-1)	
Error B	(r-1)a(b-1)	
Total	wed-1	

Lentnr & Bishop `86

3. Results and Discussion

Plant Height

The results of the analysis of variance showed that there was no interaction effect between the type of organic fertilizer and the dose of nitrogen fertilizer on the height of plants aged 7 dap, 14 dap and 21 dap. Meanwhile, at plant age of 28 days after planting, there was an interaction effect between the type of organic fertilizer and the dose of nitrogen fertilizer.

Table4The effect of the type of organic fertilizer and the dose of nitrogen fertilizer on plant height lettuce (Lactuca sativa L.).

Treatment			Average Plant Height (cm)					
			7 hst		14 hst		21 hst	
Main (Organic Fertilizer)	Plot	Cow	3.52	a	6.81	a	15.20	a
		Goat	3.55	a	6.75	a	15.02	a
		Chicken	3.50	a	6.54	a	15,14	a
Subplots (Nitrogen Fertilizer)		0 Kg/ha	3.61	a	6.96	a	14.87	a
		50 Kg/ha	3.53	a	6.71	a	13.98	a
		100 Kg/ha	3.50	a	6.41	a	14.75	a
		150 Kg/ha	3.47	a	6.72	a	16.88	a
K.K			1.70		3.08		6.67	

Note: The average value followed by the same letter on the same observation day is not significantly different at the 5% level according to the BNT test.

Table 5. The interaction between the type of organic fertilizer and the dose of nitrogen fertilizer on height lettuce plants (Lactuca saliva L.) aged 28 days after planting.

Treatment	n0 0 kg ha-1	n1 50 kg ha-1	n2 100 kg ha-1	n3 150 kg ha-1
p1 (cow)	21.75 a a	20.74 a a	23.13 b b	21.41 a a
p2 (goat)	21.48 a a	21.83 a a	21.90 a b	21.57 a a
p3 (chicken)	22.52 a b	20.89 a a	19.99 a a	20.74 a a

Note: The average values followed by the same letters (lowercase letters in the vertical direction and uppercase letters in the horizontal direction) show no significant difference at the 5% level according to the BNT test.

At the age of 28 DAT, the effect of the interaction between organic cow fertilizer and N2 nitrogen fertilizer at a dose of 100 kg ha-1 showed the highest plant height was 23.13

cm. Meanwhile, administering a dose of N0 nitrogen fertilizer with chicken organic fertilizer showed significantly different results of 22.52 cm and was no different from administering 100 kg ha-1 of N2 nitrogen fertilizer with 23.13 cm of organic cow fertilizer and goat organic fertilizer of 23.13 cm. 21.90 cm.

Number of Leaves

The results of the analysis of variance showed that there was no interaction effect between the type of organic fertilizer and the dose of nitrogen fertilizer on the number of leaves per plant aged 7 days after planting, 14 days after planting, 21 days after planting and 28 days after planting. The independent influence of the type of organic fertilizer and the dose of nitrogen fertilizer on the number of leaves also did not show any significant differences when the plants were 7 days after planting, 14 days after planting, 21 days after planting and 28 days after planting.

Table 6. The effect of the type of organic fertilizer and the dose of nitrogen fertilizer on the number of leaves per lettuce plant (Lactuca sativa L.).

Treatment		Number of leaves Per Plant			
		7 hst	14 hst	21 hst	28 hst
Main Plot (Organic Fertilizer)	Cow	2.99 a	6.05 a	11.63 a	14.98 a
	Goat	3.08 a	6.13 a	11.62 a	14.59 a
	Chicken	3.02 a	5.52 a	12.06 a	15.00 a
Subplots (Nitrogen Fertilizer)	0 l/ha	3.07 a	6.04 a	11.72 a	14.94 a
	50 l/ha	3.01 a	6.04 a	12.16 a	14.96 a
	100 l/ha	2.96 a	6.08 a	11.66 a	14.69 a
	150 1/ha	3.08 a	5.97 a	11.53 a	14.83 a
K.K		0.59	1.35	1.80	2.76

Note: The average values followed by the same letters (lowercase letters in the vertical direction and uppercase letters in the horizontal direction) show no significant difference at the 5% level according to the BNT test.

At plant age of 7 days after giving organic goat fertilizer and a dose of N3 nitrogen fertilizer showed the highest yield of 3.08. At 14 days after planting, applying goat fertilizer showed the highest yield of 6.13. At plant age of 21 days after giving a dose of 50 kg ha-1 N1 nitrogen fertilizer, the highest yield was 12.06. At plant age of 28 days after planting, giving organic chicken fertilizer showed the highest yield of 15.00.

Leaf Area Index

The results of the analysis of variance showed that there was an interaction effect between the type of organic fertilizer and the dose of nitrogen fertilizer on the leaf area index of lettuce plants.

Table7. The interaction effect of compost fertilizer type and nitrogen fertilizer dosage on the index lettuce leaf area (Lactuca sativa L).

Treatment	n0 0 kg ha-1	n1 50 kg ha-1	n2 100 kg ha-1	n3 150 kg ha-1
p1 (cow)	8.24 a b	8.52 a B	8.87 b b	7.69 a a
p2 (goat)	6.88 a	7.33 a	7.57 a	7.99 a

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	a	A	a	a
p3 (chicken)	8.19 a b	8.32 a A	8.06 a a	7.27 a a

Note: The average values followed by the same letters (lowercase letters in the vertical direction and uppercase letters in the horizontal direction) show no significant difference at the 5% level according to the BNT test.

The effect of the interaction between treatment with organic fertilizer for cattle and no nitrogen fertilizer (N0) showed the highest leaf area index of 8.80 cm2 but was not significantly different from giving organic fertilizer for cattle with a dose of N1 nitrogen fertilizer of 50 kg ha-1 of 8.52. cm and N2 100 kg ha-1 is 8.24. The results of the analysis of variance also showed that there was an interaction between administering doses of N0 fertilizer and chicken compost showing significantly different results of 8.19 and administering doses of N1 nitrogen fertilizer and cow compost showing significantly different results of 8.52 cm.

Wet Weight per Plant

The results of the analysis of variance showed that there was no interaction effect between the type of compost fertilizer and the dose of nitrogen fertilizer on the wet weight per plant.

Table 8. The effect of the type of organic fertilizer and the dose of nitrogen fertilizer on wet weight per lettuce plant (Lactuca sativa L).

Treatment		Wet Weight per Plant
Main Plot (Organic Fertilizer)	Cow	69.88 a
	Goat	70.82 a
	Chicken	72.90 a
Subplots (Nitrogen Fertilizer)	0 l/ha	70.57 a
	50 l/ha	67.36 a
	100 l/ha	76.04 b
	150 1/ha	70.82 a
K.K		14.87

Note: The average values followed by the same letters (lowercase letters in the vertical direction and uppercase letters in the horizontal direction) show no significant difference at the 5% level according to the BNT test.

The independent effect of the N2 nitrogen fertilizer dose of 100 kg ha-1 shows a significant difference of 76.04.

Crop Yield per Plot

The results of the analysis of variance showed that there was no interaction effect between the type of organic fertilizer and the dose of nitrogen fertilizer on plant yields per plot.

Table9. The effect of the type of organic fertilizer and the dose of nitrogen fertilizer on plant yields *per plot of lettuce (Lactuca sativa L).*

Treatment		Crop Yield per Plot
Main Plot (Organic Fertilizer)	Cow	55.23 b
	Goat	47.42 a
	Chicken	51.38 a
Subplots (Nitrogen Fertilizer)	0 l/ha	50.01 a
	50 l/ha	48.06 a
	100 l/ha	60.66 b
	150 1/ha	46.64 a
K.K		17.72

Note: The average values followed by the same letters (lowercase letters in the vertical direction and uppercase letters in the horizontal direction) show no significant difference at the 5% level according to the BNT test.

Based on the results of analysis of variance, the independent effect of applying nitrogen fertilizer with a dose of N2 100 kg ha-1 showed that the highest weight of plant yield per plot was 60.66 gr. Giving cow compost fertilizer also showed significantly different results of 55.23 gr.

Number of Leaves Marketable

The results of the analysis of variance showed that there was no interaction between the type of organic fertilizer and the dose of nitrogen fertilizer on the number of marketable leaves of lettuce plants. The independent influence of the type of organic fertilizer and the dose of nitrogen fertilizer also did not show significantly different results on the number of marketable leaves of lettuce plants.

Table 10. The effect of the type of organic fertilizer and the dose of nitrogen fertilizer on number of marketable leaves of lettuce plants (Lactuca sativa L).

Treatment		Leaves are Marketable
Main Plot (Organic Fertilizer)	Cow	80.36 a
	Goat	77.83 a
	Chicken	79.60 a
Subplots (Nitrogen Fertilizer)	0 l/ha	79.57 a
	50 l/ha	79.11 a
	100 l/ha	79.09 a
	150 1/ha	79.29 a
K.K		5.40

Note: The average values followed by the same letters (lowercase letters in the vertical direction and uppercase letters in the horizontal direction) show no significant difference at the 5% level according to the BNT test.

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4. Conclusion

Based on the experimental results, the effect of the type of organic fertilizer and the dose of nitrogen fertilizer on the growth and yield of lettuce plants can be concluded as follows: There was an interaction between the type of organic fertilizer for cows and the dose of N2 on plant height at 28 days after planting and leaf area index. Treatment of organic cow fertilizer and a nitrogen fertilizer dose of 100 Kg Ha-1 gave the highest plant yield of 23.13 cm and a leaf area index of 26.6 cm in lettuce plants.

5. Reference

BAIK, T. Y., & KEBUDAYAAN, R. (n.d.). TUGAS TERSTRUKTUR BUDIDAYA TANAMAN SAYUR DAN BUAH (PNA 2540).

Irawan, Y. (2020). RESPON PERTUMBUHAN DAN HASIL TANAMAN OKRA HIJAU (Abelmoschus esculentus L.) AKIBAT PEMBERIAN PUPUK KANDANG KOTORAN AYAM DI POLYBAG DENGAN BERBAGAI TAKARAN. 021008 Universitas Tridinanti Palembang.

Ismawati, D., Rahayu, T., & Rachmawatie, S. J. (2021). Pengaruh Dosis Pupuk Kandang Ayam terhadap Pertumbuhan dan Hasil Tiga Macam Varietas Selada (Lactuca sativa L.): Influence of Chicken Manure Dose to Growth and Yield on Three Varieties of Lettuce (Lactuca sativa L.). *Daun: Jurnal Ilmiah Pertanian Dan Kehutanan*, *8*(1), 10–18.

ISWARI, K. D. (2018). Pengaruh Kombinasi dosis pupuk kandang kambing dan dua jenis pupuk hayati pada pertumbuhan dan hasil tanaman bawang merah (Allium ascalonicum L.).

Mamuaja, C. F. (2016). Pengawasan mutu dan keamanan pangan. Unsrat Press.

Mansyur, N. I., Pudjiwati, E. H., & Murtilaksono, A. (2021). *Pupuk dan pemupukan*. Syiah Kuala University Press.

Manullang, I. F., Hasibuan, S., & CH, R. M. (2019). Pengaruh Nutrisi Mix Dan Media Tanam Berbeda Terhadap Pertumbuhan Dan Produksi Tanaman SeladA (Lactuca sativa) Secara Hidroponikvdengan Sistem Wick. *Bernas: Jurnal Penelitian Pertanian*, *15*(1), 82–90.

Muhadiansyah, T. O., Setyono, A. S., & Adimihardja, S. (2016). Efektivitas pencampuran pupuk organik cair dalam nutrisi hidroponik pada pertumbuhan dan produksi tanaman selada (Lactuca sativa L.). *Jurnal Agronida*, *2*(1), 37–46.

Mundari, R. (2017). Budidaya Green Butterhead (Lactuca Sativa Var. Capitata L.) secara Hidroponik Sistem Nft dengan Media Tanam Rockwool.

Nehe, R. P. (2020). Pengaruh Effective Microorganism-4 (EM-4) dan pupuk kandang ayam diperkaya pupuk NPK terhadap Pertumbuhan dan Produksi Tanaman Jagung Mini (Zea mays L.).

Nurdiansyah, R. (2020). Pengaruh Nutrisi AB MIX dan POC Limbah Sayuran Terhadap Pertumbuhan dan Hasil Tanaman Bayam Merah (Amaranthus tricolor L.) Varietas Mira Dengan Sistem Hidroponik Rakit Apung (Floating Raft). *Jurnal Pertanian Indonesia*, *1*(1), 22–26.

Pratiwi, P. R., Subandi, M., & Mustari, E. (2015). Pengaruh tingkat EC (electrical conductivity) terhadap pertumbuhan tanaman sawi (Brassica juncea L.) pada sistem instalasi aeroponik vertikal. *Jurnal Agro*, *2*(1), 50–55.

Rochman, F. (2017). Pengaruh konsentrasi insektisida berbahan aktif klorpirifos 400 g/L terhadap serangan hama kumbang daun (Phyllotreta vittata F.) dan hasil pada tanaman sawi (Brassica juncea L.). *Jurnal Agrorektan*, *4*(1).

Wahyudi, T. (2020). Pengelolaan komoditas hortikultura unggulan berbasis lingkungan. Forum Pemuda Aswaja.

Wahyudin, A., & Irwan, A. W. (2019). Pengaruh dosis kascing dan bioaktivator terhadap pertumbuhan dan hasil tanaman sawi (Brassica juncea L.) yang dibudidayakan secara organik. *Jurnal Kultivasi Vol*, *18*(2).